

Board – ICSE

Class – 9

Topic – Respiratory System

**Q1. Name the following:**

- (i) The condition in which the oxygen supply to the respiratory system is cut off.
- (ii) The membrane enveloping the lungs.
- (iii) The part of the tidal air that effectively takes part in the gaseous exchange in the lungs.
- (iv) Sum total of tidal volume, inspiratory reserve volume and expiratory reserve volume.
- (v) A muscular sheet of tissue extending across the body cavity between thorax and abdomen.

**Ans.** (i) Asphyxiation (ii) Pleura (iii) Alveolar air (iv) Vital capacity of lung (v) Diaphragm.

**Q2. Fill in the blanks:**

- (i) \_\_\_\_\_ of the lungs is the volume of air that can be taken in and expelled by maximum inspiration and expiration. (vital capacity / total lung capacity / tidal volume)
- (ii) The respiratory centre is located in the \_\_\_\_\_. (cerebrum / cerebellum / medulla oblongata)
- (iii) Nasal passage is lined by \_\_\_\_\_. (flagella/ciliated epithelium/cilia)
- (iv) Exchange of air takes place between capillaries and \_\_\_\_\_. (alveoli / bronchi / trachea)
- (v) Respiration is a \_\_\_\_\_ process. (physical / chemical/ biochemical)

**Ans.** (i) Vital capacity (ii) Medulla oblongata (iii) Ciliated epithelium (iv) Alveoli (v) Biochemical.

**Q3. Mention, if the following statements are true or false. If false, rewrite the correct sentence.**

- (i) Total alveolar surface in adult man is 100 m<sup>2</sup>
- (ii) Oxygen combines with the globin part of haemoglobin.
- (iii) Cartilaginous rings around the trachea prevent its collapse.
- (iv) Tidal volume is the volume of air breathed in or out with maximum effort.
- (v) Residual volume is the volume of air left in the lungs after the deepest expiration.

**Ans.** (i) True (ii) False (Haemo) (iii) True (iv) False (Vital capacity) (v) True

**Q4. Which are the three activities involved in the internal respiration?**

- Ans.** (i) Oxygen uptake by tissue cells.  
(ii) Oxidation of food material with the help of oxidising enzymes inside tissues.  
(iii) Elimination of CO<sub>2</sub> from the tissues.

**Q5. What are the steps involved in pulmonary respiration?**

- Ans.** (i) Pulmonary respiration requires breathing movements which includes inspiration and expiration.  
(ii) Inspired air is exchanged over the surface of alveoli where O<sub>2</sub> is taken in and CO<sub>2</sub> given out.  
(iii) The oxygen taken in is transported to the tissues and carbon-dioxide laden air is expired out.

**Q6. What is the requirement of highly efficient surface for gas exchange?**

- Ans.** Efficient respiratory surface should have large surface area. It should be thin, easily permeable and should be highly vascular.

**Q7. Differentiate between the following pairs on the basis of the aspect given in the brackets.**

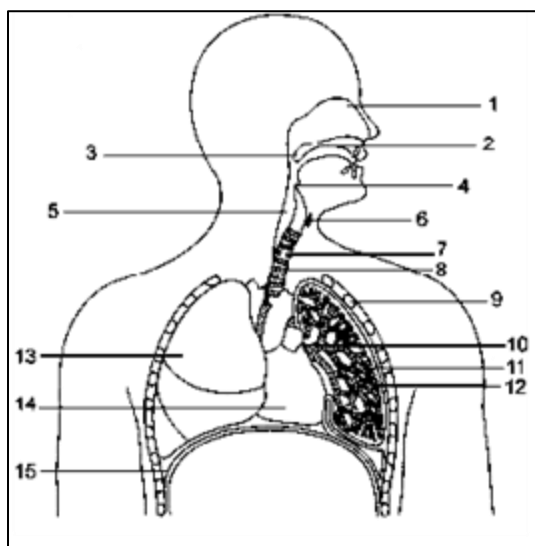
- (i) Catabolism and anabolism (Nature of reaction)
- (ii) Pleural fluid and pericardial fluid (function)
- (iii) Aerobic and anaerobic respiration (end products of the process)
- (iv) Respiration and photosynthesis (gas released)
- (v) Aerobic and anaerobic respiration (end products)

- Ans.** (i) Catabolism: Biochemical reactions involved in the breakdown of complex protoplasmic molecules to simpler ones are collectively called catabolism.  
Anabolism: Biochemical reactions involved in the synthesis of complex protoplasmic molecules from simple ones are collectively called anabolism.  
(ii) Pleural fluid lubricates the lung, while pericardial fluid lubricates the heart.  
(iii) Aerobic respiration involves complete breakdown of glucose in absence of air, liberating large amount of energy (38 ATP). Anaerobic respiration involves incomplete breakdown of glucose in absence of air, liberating only 2 molecules of ATP.  
(iv) CO<sub>2</sub> is released in respiration. O<sub>2</sub> (oxygen) is released in photosynthesis.  
(v) Aerobic respiration – end products are carbon dioxide, water, energy (38 ATP).

Anaerobic respiration – end products are lactic acid, energy (2 ATP).

**Q8. The figure below shows a ventral view of human thorax.**

- (i) Label 1-15
- (ii) What are the devices for the protection of lungs?
- (iii) What is the importance of structure 12?
- (iv) Why is the trachea lined with C-shaped rings of cartilage?
- (v) With the help of ray diagram, name all parts in a sequence, through which atmospheric air reaches the last part of our lungs.



**Ans.** (i) 1-Nasal cavity; 2-Hard palate; 3-Soft palate; 4-Epiglottis; 5-Oesophagus; 6-Larynx; 7-Cartilaginous rings; 8-Trachea; 9- Cut end of ribs; 10-Bronchus; 11-Bronchiole; 12-Alveolus; 13-Right lung; 14-Diaphragm; 15-Pleural membrane.

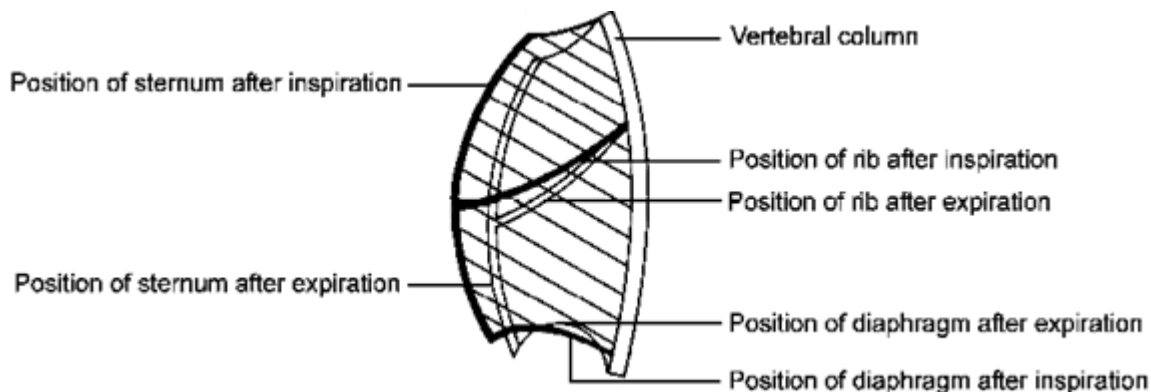
(ii) Lungs are protected by a rib cage and the pleura forms a protective membrane over the lungs.

(iii) Alveoli offers a good respiratory surface for gaseous exchange.

(iv) Trachea is protected against closure by a series of closely packed C-shaped rings of cartilage. These cartilaginous rings support the wall of trachea on the dorsal side to prevent them from collapsing. The trachea remains open permanently and allows easy passage of air.

(v) Nasal cavity → Nasopharynx → Larynx → Trachea → Bronchi and Bronchioles → Alveolar ducts → Alveolar air sacs → Pulmonary alveoli.

**Q9.** Given below is the relative position of ribs, diaphragm and sternum after breathing in and out.



- (i) Differentiate between inspiration and expiration with reference to intercostal muscles and diaphragm.
- (ii) What is the composition of the inspired air? How is it different from the expired air?
- (iii) How will you prove that water is released during breathing?
- (iv) "When we hold our breath, the exchange of gases does not stop for some time." Explain this statement.

**Ans.** (i)

| Inspiration                                                                                                                                                                           | Expiration                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| (a) Intercostal muscles<br>These muscles contract, raising the lower portion of the sternum forward and the lower ribs upwards and outwards increasing the volume of thoracic cavity. | The muscles relax and the sternum is pulled in and ribs are depressed under their own weight, thus the volume of thoracic cavity is reduced. |
| (b) Diaphragm<br>It contracts and flattens, thus increasing the volume of the thoracic cavity.                                                                                        | Diaphragm relaxes and returns to its arched position, thus decreasing the volume of the thoracic cavity.                                     |

(ii)

| Component      | Inspired Air | Expired Air |
|----------------|--------------|-------------|
| Oxygen         | 20.14%       | 16.3%       |
| Carbon dioxide | 0.3%         | 4.0%        |
| Nitrogen       | 79.03%       | 79.7%       |
| Water vapour   | Low          | High        |

- (iii) Gently breathe upon a cold surface, such as a piece of glass or slate; the water droplets appearing on the surface prove the presence of moisture in expired air.
- (iv) This is due to the presence of residual volume of air in lungs.

**Q10. What is the function of Adam's apple?**

- Ans.** (i) Adam's apple also called the voice box consists of two ligamentous folds called vocal cords. Vibrations of these cords produce sounds.
- (ii) It also functions as a passage for air.

**Q11. Design an experiment to demonstrate that expired air contains more carbon dioxide than inspired air.**

**Ans. Aim:** To prove that expired air contains more carbon dioxide than inspired air.

**Apparatus:** A T-tube with clips, two flasks containing lime water, delivery tubes.

**Procedure:** The apparatus is set up as shown.

**Clip X open, Clip Y closed**

Breathe in (inhale) through the tube at the centre.

**Clip X closed, Clip Y open**

Breathe out (exhale) through the tube at the centre.

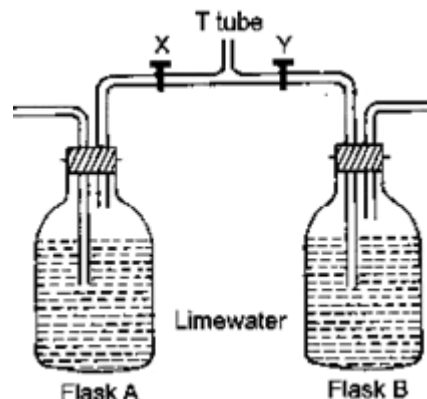
Repeat the above procedure about 10-15 times.

**Observation:** Lime water in flask B turns milky faster than the lime water in flask A.

**Inference:** When clip X is open and clip Y closed, atmospheric air is drawn to the flask A.

When clip X is closed and clip Y is opened, exhaled air is forced into flask B.

The result of the experiment shows that expired air contains more carbon dioxide than inspired air.



**Q12. Breathing through nose is said to be healthier than through the mouth.**

**Ans.** Breathing through nose allows the air to undergo filtration in the nasal chambers, cleaning by trapping minute dust and other particles in mucus and cilia push them outwards, sterilization with the help of chemicals present in mucus, moistening through water vapour coming from mucus and changing the temperature while passing over lining of nasal cavity. It is, therefore, said that breathing through nose is healthier than through the mouth.

**Q13. Alveoli offer a good respiratory surface for gaseous exchange. Comment.**

**Ans.** The alveoli offer a good respiratory surface for gaseous exchange:

- (a) The alveoli have thin walls, made of single layer epithelium which is readily permeable to gases.
- (b) Elastic structure and smooth muscle fibres make the alveoli easily distensible and capable of accommodating large air volumes.
- (c) Each alveolus is covered with a thick net of capillaries derived from the pulmonary artery.
- (d) The lining of the alveoli is covered with a film of moisture. Oxygen dissolves in the moisture and diffuses through the epithelium and capillary walls into the blood where it combines with the hemoglobin.
- (e) Both lungs contain 300 to 400 million microscopic alveoli which in a normal adult have a diameter of 0.2 mm., the lungs have an enormous respiratory surface (almost 100 m<sup>2</sup> during inspiration in an average adult).

**Q14. Choose the right answer out of the four choices given in each case. The (alveoli/bronchioles/tracheoles/bronchi) are the ultimate end parts of the respiratory system in humans.**

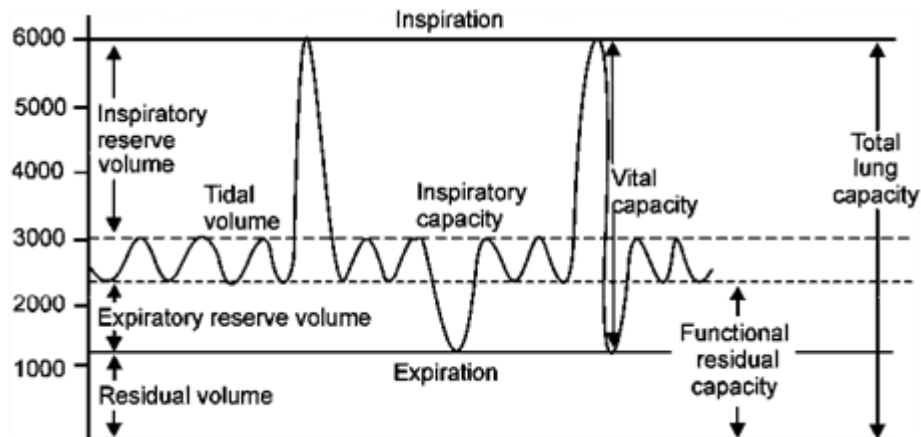
**Ans.** Alveoli.

**Q15. Match the items in column I with the ones most appropriate in column II. Rewrite the matching pairs.**

| Column I            | Column II                          |
|---------------------|------------------------------------|
| (i) Alveoli         | Lined with hair                    |
| (ii) Bronchioles    | Diffusion of gases                 |
| (iii) Nasal chamber | Small air tubes                    |
| (iv) Pharynx        | A common passage for food and air. |

- Ans.** (i) Alveoli – diffusion of gases.  
(ii) Bronchioles – small air tubes.  
(iii) Nasal chamber – lined with hair  
(iv) Pharynx – a common passage for food and air.

**Q16.** The volume of air in the lungs and the rate at which it is exchanged during inspiration and expiration is measured with a spirometer. The following diagram shows the spirogram of lung volumes and capacities. Study the graph carefully and explain briefly the following:



- (i) Tidal volume (TV).
- (ii) Inspiratory reserve volume (IRV).
- (iii) Expiratory reserve volume (ERV).
- (iv) Vital capacity (VC).
- (v) Residual volume (RV).

**Ans.** (i) Air breathed in and out in a normal quiet breathing (500 cm<sup>3</sup>).

(ii) Air that can be drawn in forcibly over and above the tidal air (3000 cm<sup>3</sup>).

(iii) Air that can be expelled out forcibly after an ordinary respiration (1000 cm<sup>3</sup>).

(iv) The volume of air that can be taken in and expelled out by maximum inspiration and expiration (vital capacity = 4500 cm<sup>3</sup>).

(v) The leftover air in the lungs even after forcibly breathing out (1500 ml)